WHAT IS CLAIMED IS:

1. A transgene for producing a recombinant polypeptide in transgenic bovine species comprising at least one expression regulation DNA sequence functional in at least one cell-type of said bovine species operably linked to a recombinant DNA encoding a recombinant polypeptide, wherein said transgene is capable of directing the expression of said recombinant DNA sequence in at least said one cell-type of a bovine species containing said transgene to produce said recombinant polypeptide.

2. The transgene of Claim 1 wherein said expression regulation sequences comprise 5' and 3' expression regulation sequences from a serum albumin, said cell-type is liver cell, said recombinant polypeptide is human serum albumin and said transgene further comprises a secretory DNA sequence functional in said liver cells and operably linked to the recombinant DNA encoding said human serum albumin.

3. A transgene for producing a recombinant polypeptide in the milk of transgenic bovine species comprising at least one expression regulation DNA sequence functional in the mammary secretory cells of said bovine species, a secretory DNA sequence encoding a secretory signal sequence also functional in the mammary secretory cells of said bovine species and a recombinant DNA sequence encoding a recombinant polypeptide, wherein said secretory DNA sequence is operably linked to said recombinant DNA sequence and to form a secretory-recombinant DNA sequence said at least one expression regulation sequence operably linked to said secretory-recombinant DNA sequence, such that said transgene is capable of directing the expression of said secretory-recombinant DNA sequence in mammary secretory cells of

bovine species containing said transgene to produce a form of recombinant polypeptide which when secreted from said mammary secretory cells produces recombinant polypeptide in the milk of said bovine species.

4. The transgene of Claim 1 or 3 further comprising a recombinant intervening sequence.

5. The transgene of Claim 4 wherein said recombinant intervening sequence is a hybrid intervening sequence.

6. The transgene of Claim 5 wherein said hybrid intervening sequence contains a permissive RNA splice signal.

7. The transgene of Claim 3 wherein said recombinant polypeptide is a homologous polypeptide from bovine species.

8. The transgene of Claim 7 wherein said homologous polypeptide is selected from the group consisting of caseins, lactoferrin, lysozyme, cholesterol hydrolase and serum albumin.

9. The transgene of Claim 3 wherein said recombinant polypeptide is a heterologous polypeptide.

10. The transgene of Claim 9 wherein said heterologous polypeptide is selected from the group consisting of human milk proteins, human serum proteins, and industrial enzymes.

11. The transgene of Claim 10 wherein said heterologous polypeptide is a human milk protein.

12. The transgene of Claim 11 wherein said human milk protein is selected from the group consisting of secretory immunoglobulins, lysozyme, lactoferrin, lactoglobulin, α-lactalbumin and bile salt-stimulated lipase.

13. The transgene of Claim 12 wherein said milk protein is lactoferrin or lysozyme.

14. The transgene of Claim 10 wherein said heterologous polypeptide is a human serum protein.

15. The transgene of Claim 14 wherein said human serum protein is selected from the group consisting of albumin, immunoglobulin, Factor VIII, Factor IX and Protein C.

16. The transgene of Claim 15 wherein said serum protein is albumin.

17. The transgene of Claim 10 wherein said heterologous polypeptide is an industrial enzyme selected from the group consisting of proteases, lipases, chitinases and ligninases.

18. The transgene of Claim 3 wherein said secretory DNA sequence is selected from the group consisting of DNA sequences encoding secretory signal sequences from human lactoferrin, human serum albumin, human lysozyme and secretory signal sequences from bovine αS1-casein, αS2-casein, β-casein, κ-casein, α-lactalbumin, β-lactoglobulin, and serum albumin.

19. The transgene of Claim 18 wherein said secretory DNA sequence is the DNA sequence encoding the signal secretion sequence of bovine αS1 casein.

20. The transgene of Claim 3 wherein said at least one expression regulation sequence comprises 5' expression regulation DNA sequences operably linked to the 5' end of said secretory-recombinant DNA sequence.

21. The transgene of Claim 20 wherein said 5' expression regulation DNA sequence is selected from the group consisting of 5' expression regulation sequence from bovine genes encoding αS1-casein, αS2-casein, β-casein, κ-casein, α-lactalbumin, and β-lactoglobulin.

22. The transgene of Claim 21 wherein said 5' expression regulation DNA sequence is a proximal 5' expression regulation sequence comprising the promoter of bovine αS1-casein.

23. The transgene of Claim 22 wherein said 5' expression regulation DNA sequence further comprises a distal 5' expression regulation sequence comprising 5'-flanking DNA sequence from bovine αS1-casein.

24. The transgene of Claim 20 further comprising 3' expression regulation sequences operably linked to the 3' end of said secretory-recombinant DNA sequence.

25. The transgene of Claim 24 wherein said 3' expression regulation sequence comprise 3' expression regulation sequence from bovine genes encoding αS1-casein, αS2-casein, β-casein, k-casein, α-lactalbumin, and β-lactoglobulin.

26. The transgene of Claim 25 wherein said 3' expression regulation DNA sequence comprises a 3' proximal expression regulation sequence from bovine αS1-casein.

27. The transgene of Claim 26 wherein said 3' expression regulation DNA sequence further comprises a 3' distal expression regulation sequence from bovine αS1-casein.

28. The transgene of Claim 27 wherein said distal 5' expression regulation DNA sequence comprises about a 30 kb 5'-flanking region of bovine αS1-casein and said distal 3' expression regulation DNA sequence comprises about a 15 kb 3'-flanking region of bovine αS1-casein.

29. A transgenic bovine species capable of producing a recombinant polypeptide in at least one cell type of said animal.

30. A transgenic bovine species capable of producing recombinant polypeptide in the milk of said transgenic species.

31. The transgenic bovine species of Claim 30 wherein said recombinant polypeptide is a homologous polypeptide from bovine species.

32. The transgenic bovine species of Claim 30 wherein said recombinant polypeptide is a heterologous polypeptide.

33. The transgenic bovine species of Claim 32 wherein said heterologous polypeptide is selected from the group consisting of human milk proteins, human serum proteins, and industrial enzymes.

34. The transgenic bovine species of Claim 33 wherein said heterologous polypeptide is a human milk protein.

35. The transgenic bovine species of Claim 34 wherein said human milk protein is selected from the group consisting of secretory immunoglobulins, lysozyme, lactoferrin, lactoglobulin, α-lactalbumin and bile salt-stimulated lipase.

36. The transgenic bovine species of Claim 35 wherein said milk protein is lactoferrin or lysozyme.

37. The transgenic bovine species of Claim 33 wherein said heterologous polypeptide is a human serum protein.

38. The transgenic bovine species of Claim 37 wherein said human serum protein is selected from the group consisting of albumin, immunoglobulin, Factor VIII, Factor IX and Protein C.

39. The transgenic bovine species of Claim 38 wherein said serum protein is albumin.

40. The transgenic bovine species of Claim 33 wherein said heterologous polypeptide is an industrial enzyme selected from the group consisting of proteases, lipases, chitinases and ligninases.

41. Milk from transgenic bovine species containing a recombinant polypeptide.

42. The milk of Claim 41 wherein said recombinant polypeptide is a homologous polypeptide from bovine species.

43. The milk of Claim 41 wherein said recombinant polypeptide is a heterologous polypeptide.

44. The milk of Claim 43 wherein said heterologous polypeptide is selected from the group consisting of human milk proteins, human serum proteins, and industrial enzymes.

45. The milk of Claim 44 wherein said heterologous polypeptide is a human milk protein.

46. The milk of Claim 45 wherein said human milk protein is selected from the group consisting of secretory immunoglobulins, lysozyme, lactoferrin, lactoglobulin, α-lactalbumin and bile salt-stimulated lipase.

47. The milk of Claim 46 wherein said milk protein is lactoferrin or lysozyme.

48. The milk of Claim 43 wherein said heterologous polypeptide is a human serum protein.

49. The milk of Claim 48 wherein said human serum protein is selected from the group consisting of albumin, immunoglobulin, Factor VIII, Factor IX and Protein C.

50. The milk of Claim 49 wherein said serum protein is albumin.

51. A food formulation comprising transgenic milk containing a recombinant polypeptide.

52. The food formulation of Claim 51 wherein said recombinant polypeptide is at least partially purified from said transgenic milk.

53. The food formulation of Claim 51 formulated with nutrients appropriate for infant formula.

54. A method for producing a transgenic bovine species capable of producing a recombinant polypeptide in the milk of said bovine species, said method comprising:

introducing the transgene of Claim 1 into an embryonal target cell of a bovine species;

transplanting the transgenic embryonal target cell formed thereby or the embryo obtained herefrom into a recipient female bovine parent; and

identifying at least one female offspring which is capable of producing said recombinant polypeptide in the milk of said offspring.

55. A method for producing a transgenic non-human mammal having a desirable phenotype comprising:

(a) methylating a transgene capable of conferring said phenotype when incorporated into the cells of said transgenic non-human animal;

(b) introducing said methylated transgene into fertilized oocytes of said non-human mammal to permit integration of said transgene into the genomic DNA of said fertilized oocytes;

(c) culturing the individual oocytes formed hereby to pre-implantation embryos, thereby replicating the genome of each of said fertilized oocytes;

(d) removing at least one cell from each of said pre-implantation embryos and lysing said at least one cell to release the DNA contained therein;

(e) contacting said released DNA with a restriction endonuclease capable of cleaving said methylated transgene but incapable of cleaving the unmethylated form of said transgene formed after integration into and replication of said genomic DNA; and

(f) detecting which of said cells from said pre-implantation embryos contain a transgene which is resistant to cleavage by said restriction endonuclease

as an indication of which pre-implantation embryos have integrated said transgene.

56. The method of Claim 55 wherein said removal of at least one cell forms a first and second hemi-embryo for each of said pre-implementation embryos and each of said first hemi-embryos is lysed and analyzed according to steps (d) through (f), said method further comprising;

(g) cloning at least one of said second hemi-embryos; and

(h) to form a multiplicity of transgenic embryos.

57. The method of Claim 56 further comprising transplanting more than one of said transgenic embryos into recipient female parents to produce a population containing at least two transgenic non-human animals having the same genotype.

58. The method of Claim 55 further comprising transplanting the remainder of said pre-implantation embryo containing a genomically integrated transgene into a recipient female parent and identifying at least one offspring having said phenotype.

59. The method of Claim 55 wherein said restriction endonuclease is DPNI and said transgene is methylated at N6 of the adenine of the sequence GATC contained within said transgene.

60. The method of Claim 59 wherein said detection utilizes a polymerase chain reaction using extension primers complementary to sequences upstream and downstream to said GATC sequence.

61. The method of Claim 59 wherein said non-human transgenic mammal is bovine species, said transgene encodes a recombinant polypeptide and said desired phenotype is the ability to produce said recombinant polypeptide in the milk of said bovine species.

62. The method of Claim 61 wherein said transgene is the transgene of Claim 3.

63. A transgene for producing a recombinant polypeptide in the milk of transgenic bovine species comprising:

(i) a bovine 5' expression regulation sequence;

(ii) a secretory DNA sequence encoding a secretory signal sequence functional in the mammary secretory cells of the bovine species;

(iii) a recombinant DNA sequence encoding a recombinant polypeptide, said secretory DNA sequence being operably linked to said recombinant DNA sequence, wherein a secretory-recombinant DNA sequence is formed, said secretory-recombinant DNA sequence being operably linked to said bovine expression regulation sequence;

(iv) a 3' untranslated sequence;

(v) a 3' flanking sequence of a bovine gene; and

wherein said transgene is capable of directing the expression of said secretory-recombinant DNA sequence in mammary secretory cells of bovine species containing said transgene
to produce a form of recombinant polypeptide which when secreted from said mammary secretory cells produces recombinant polypeptide in the milk of said bovine species.

64. The transgene of claim 63, further comprising a recombinant intervening sequence.

65. The transgene of claim 64 wherein the recombinant intervening sequence is a hybrid intervening sequence.

66. The transgene of claim 65 wherein the hybrid intervening sequence comprises a 5' portion of an intervening sequence from bovine α-S_1-casein and a 3' sequence portion of an IgG heavy chain intervening sequence.

67. The transgene of claim 66 wherein the 3' sequence portion is a 3' splice signal sequence associated with the J-C segment rearrangement of an IgG heavy chain.

68. The transgene of claim 63, wherein the bovine expression regulation sequence and the 3' flanking sequence are derived from the same bovine gene.

69. The transgene of claim 63, wherein the bovine expression regulation sequence, the 3' untranslated sequence, and the 3' flanking sequence are derived from the same bovine gene.

70. The transgene of claim 68 or claim 69 wherein the bovine gene is α-S_1-casein.

71. The transgene of claim 70 wherein the bovine expression regulation sequence comprises about a 30kb 5'-flanking region of bovine αS1-casein and the 3'-flanking sequence comprises about a 15kb 3'-flanking region of bovine αS1-casein.

72. The transgene of claim 3 or claim 63 wherein the milk comprises greater than 50 micrograms of the recombinant polypeptide per milliliter.

73. A transgenic bovine species capable of producing a recombinant polypeptide in saliva.

74. The semen of a transgenic bovine.

75. A transgene for producing a recombinant polypeptide in the milk of transgenic bovine species comprising:

(i) a 5' expression regulation sequence;

(ii) a secretory DNA sequence encoding a secretory signal sequence functional in the mammary secretory cells of the bovine species;

(iii) a recombinant DNA sequence encoding a recombinant polypeptide, said secretory DNA sequence being operably linked to said recombinant DNA sequence, wherein a secretory-recombinant DNA sequence is formed, said secretory-recombinant DNA sequence being operably linked to the 5' expression regulation sequence;

(iv) a 3' untranslated sequence; and,

(v) a 3' flanking sequence from a human gene;

wherein the transgene is capable of directing the expression of the secretory-recombinant DNA sequence in mammary secretory cells of bovine species containing the transgene
to produce a form of recombinant polypeptide which when secreted from the mammary secretory cells produces recombinant polypeptide in the milk of the bovine species.

76. The transgene of claim 75, wherein the 5' expression regulatory sequence is a bovine sequence.

77. The transgene of claim 75 or claim 76, wherein the 3' flanking sequence is from the human lactoferrin (hLF) gene.

78. The transgene of claim 77, wherein the 3' flanking sequence is 9 kilobase pairs in length.

79. The transgene of claim 77, wherein the recombinant polypeptide is human lactoferrin.

80. The transgene of claim 75, wherein the 5' expression regulation sequence, the secretory DNA sequence, the recombinant DNA sequence encoding a recombinant polypeptide, the 3' untranslated sequence; and the 3' flanking sequence are from a human gene.

81. The transgene of claim 80, wherein the human gene is the lactoferrin gene.

82. A method for expressing a human polypeptide in the milk of a bovine comprising:

introducing a human genomic fragment encoding the human polypeptide into an embryonal target cell of a bovine species;

transplanting the transgenic embryonal target cell formed thereby or the embryo obtained therefrom into a recipient female bovine parent; and

identifying at least one female offspring which is capable of producing the recombinant polypeptide in the milk of the offspring.

83. The method of claim 82, wherein the human polypeptide is lactoferrin.

84. A transgene for producing a recombinant polypeptide in the milk of transgenic bovine species, said transgene comprising:

(i) a 5' expression regulation sequence from a first milk protein gene;

(ii) a recombinant DNA sequence from a second milk protein gene encoding a recombinant polypeptide;

(iii) a secretory DNA sequence from said first or second milk protein gene, said secretory DNA sequence encoding a secretory signal sequence functional in the mammary secretory cells of the bovine species, and said secretory operably linked to said recombinant DNA sequence and to said 5' expression sequence;

(iv) a 3' untranslated sequence from said first or second milk protein gene; and

(v) a 3' flanking sequence from said first or second milk protein gene;

wherein the transgene is capable of directing the expression of the secretory-recombinant DNA sequence in mammary secretory cells of bovine species containing the transgene
to produce a form of recombinant polypeptide which when secreted from the mammary secretory cells produces recombinant polypeptide in the milk of the bovine species.

85. The transgene of claim 84, further comprising: a 5' untranslated sequence from said first or second milk protein gene.

86. The transgene of claim 85, wherein said recombinant DNA sequence is a genomic sequence comprising at least one intronic sequence.

87. The transgene of claim 86, wherein said first gene is a bovine αS1-casein gene.

88. The transgene of claim 86, wherein said first gene is a bovine β-lactoglobulin gene.

89. The transgene of claim 87, wherein said second gene is a human lactoferrin gene.

90. The transgene of claim 88, wherein said second gene is a human lactoferrin gene.

91. The transgene of claim 87, wherein the second gene is a human lysozyme gene.

92. The transgene of claim 89, wherein said 3' untranslated sequence and said 3' flanking sequence are from said second gene.

93. The transgene of claim 89, wherein said 3' untranslated sequence and said 3' flanking sequence are from said first gene.

94. The transgene of claim 90, wherein said 3' untranslated sequence and said 3' flanking sequence are from said second gene.

95. The transgene of claim 91, wherein said 3' untranslated sequence and said 3' flanking sequence are from said first gene.

96. A method of producing a transgenic bovine species of claim 29, said method comprising:

obtaining a plurality of ova from bovine ovaries;

fertilizing said ova in vitro to form zygotes;

introducing a transgene, capable of being expressed in at least one cell type of said transgenic bovine species to produce said recombinant polypeptide, into said zygotes;

propagating said zygotes to form embryos;

transplanting said embryos into a recipient female bovine parent;

identifying at least one offspring containing said transgene; and

breeding said offspring to produce said transgenic bovine species.

97. The method of claim 96, wherein in said introducing step, said zygotes are substantially synchronous.